

# Teaching Mathematics in Culturally and Linguistically Diverse Classrooms: Greek-Cypriot Elementary Teachers' Reported Practices and Professional Needs

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*In this article, the author presents and discusses findings from a small-scale qualitative project that included Greek-Cypriot elementary mathematics teachers working in schools with high percentages of immigrant pupils. Working in three neighbouring schools in the same underprivileged urban area, 16 teachers were individually interviewed regarding their experiences of teaching mathematics in those settings. The author discusses the teachers' reported instructional practices in facilitating their pupils' mathematical understanding, as well as their professional needs for doing so. The author's analysis suggests that teachers focused solely on providing linguistic support for their pupils, without any attempt to incorporate their pupils' diverse cultural backgrounds in classrooms. Also, the participants reported a number of professional needs not currently addressed by the Ministry of Education and Culture of the Republic of Cyprus. Some implications for policy and practice are discussed.*

**Keywords:** Cyprus, diversity, elementary teachers, mathematics education, professional needs, reported practices

Teaching mathematics in diverse classrooms is a complex and challenging endeavour (Anhalt & Rodríguez-Pérez, 2013; Clarkson, 2004), not least because in such settings (as in all classrooms) mathematical content intertwines with issues of language and culture. Researchers have shown that in multilingual mathematics classrooms several types of discourse—ranging from the everyday to the formal mathematical register—interchange and coexist (Clarkson, 2009; Slavit & Ernst-Slavit, 2007). At the same time, pupils who are learning the language of instruction alongside mathematics may have difficulty accessing mathematical content presented in verbal forms (Elbers & de Haan, 2005). Furthermore, it has been well documented that the content of mathematics curricula as well as the teaching and learning of the subject vary significantly across countries (Andrews, 2007, 2014; Bishop, 1994; Campbell & Kyriakides, 2000). Immigrant and minority pupils bring their ethnic cultures' mathematical values and aspirations to class-

rooms (Gorgorio, 2006; Stathopoulou & Kalabasis, 2007), which are not, however, always welcomed by teachers.

In this article, I draw on data from a small-scale project examining Greek-Cypriot elementary teachers' beliefs about mathematics teaching and learning in diverse settings. The following two research questions are addressed:

1. What are teachers' reported practices in facilitating immigrant pupils' learning of mathematics?
2. What professional needs do teachers have in assisting their immigrant pupils' learning of mathematics?

A small Mediterranean island and a member of the European Union (EU) since 2004, the Republic of Cyprus has had a diverse demographic character even before its declaration as a Republic in 1960 (Hajisoteriou, Neophytou, & Angelides, 2012). Over the last few years, however, a great number of immigrants and labour workers from East Asia, Eastern Europe, the former Soviet Union, and the Middle East has arrived to the island, along with some internal movement of Turkish Cypriots from the north part of the island—occupied by Turkish military forces since 1974—to the south part, controlled by the internationally recognized Republic of Cyprus (Zembylas & Lesta, 2011). According to the latest census for the government-controlled part of the island (Statistical Service of the Republic of Cyprus, 2011), 667,398 inhabitants have Cypriot citizenship (including people with dual citizenship); 106,270 have EU citizenship; and 64,113 a non-EU citizenship. About half of the people who migrated to the Cyprus Republic in the last decade are female domestic workers, while a high percentage of the rest is employed in agriculture, the tourism industry, and in construction (Zembylas & Lesta, 2011).

The changing demographics of the population have certainly altered the pupil population of the Republic (Angelides, Stylianou, & Leigh, 2003; Zembylas & Lesta, 2011). The Ministry of Education and Culture (MoEC) first expressed an explicit interest in diversity issues in 2001 (Hajisoteriou et al., 2012). In 2003, the program for Zones of Educational Priority (ZEP), a UNESCO strategy for positive discrimination (or what in the U.S. context is called affirmative action), was introduced as a way to promote “tolerance and dialogue in order to eliminate stereotypes through education” (MoEC, 2008, p. 21). ZEP schools are typically located in areas of low socioeconomic status, and their pupil population typically comprises high proportions of immigrant or other-language children.

The vast majority of these pupils do not speak Greek (the language of instruction), and so they have to take reception classes a few hours a week to learn the language (Papamichael, 2008). At the same time, they have to attend “regular” classes with their local peers (Hadjitheodoulou-Loizidou & Symeou, 2007) for all school subjects. The same teachers who teach in the so-called regular class typically

teach reception classes. These teachers do not need to have any further qualifications (i.e., teaching Greek as a second, additional, and/or foreign language) to teach in the reception classes. This decision is simply a matter of how the school management distributes the teaching periods to its employees. The MoEC has provided most ZEP schools with a particular book series, originally developed in Greece, as part of a research project for teaching the language to children of the Greek diaspora. However, anecdotal evidence indicates that most ZEP teachers in the Cyprus Republic do not use the series, because, as they claim, it was developed for different purposes and does not take the particularities of the Greek-Cypriot educational system into consideration. Instead, they would rather prepare their own teaching materials (i.e., worksheets) or treat reception classes as tutorials to what has been taught in the regular class.

In a previous article (Xenofontos, 2015), I discuss findings from the project reported here regarding particular ZEP schoolteachers' views of immigrant and other-language pupils as learners of mathematics. As concluded there, the participants made direct references to language as the main (in most cases, the only) factor that prohibits pupils' mathematical learning. It was observed that if pupils managed to overcome the linguistic barriers by learning basic Greek, then learning the mathematical content would be easy given that mathematics was perceived as a universal language. Nevertheless, some of the teachers made peripheral references to pupils' ethnic cultures as another factor that might impact the latter's mathematical ability. More specifically, teachers commented on how pupils from certain ethnic groups appeared to perform better than those of other ethnic backgrounds (i.e., Russian speakers performing better than Arabic speakers); they also noted that the parents of those who performed well seemed to value school and mathematics more than the parents of those who underperformed. The teachers' comments, however, were based solely on anecdotal observations, making it apparent that they lacked the necessary vocabulary and scientific knowledge to justify such claims.

Based on the same dataset, here I discuss teachers' reported teaching strategies in facilitating immigrant pupils' mathematical understanding, as well as their professional needs. Because research on Greek-Cypriot mathematics teachers' practices and needs for teaching in diverse classrooms is largely overlooked (Xenofontos, 2015), I turn my focus to international literature in this area, which has been helpful in framing and locating my work. While I am aware that diverse educational policies have a local character and are perceived differently in dissimilar educational systems (Gorski, 2006; Gropas & Triandafyllidou, 2011), I am confident, despite the cultural specificities of my work, that the research reported here will enable dialogue among colleagues with similar concerns around the globe.

## **Teachers' Concerns and Practices in Diverse Mathematics Classrooms**

In this section, I summarize the relevant international literature on mathematics teachers' concerns and instructional practices in diverse classrooms. From my readings, it could be inferred that research in this field typically falls into two clusters.

The first cluster comprises research focusing on the issue of language. Language plays a vital role in developing a deep conceptual understanding of mathematical ideas (Durkin, 1991); therefore, pupils learning mathematics in a language other than their home language need explicit and deliberate linguistic support (Anhalt & Rodríguez-Pérez, 2013). In view of this, Clarkson (2004, 2009) highlights several practices employed by teachers in such settings, which have been found to be effective for pupils' learning. For example, teachers may encourage different types of language practice; that is, informal talk in the pupils' home language can lead to more formal mathematical talk in the language of instruction (Salehmohamed & Rowland, 2014). Such encouragement has proven to have a positive impact on pupils' conceptual understanding of mathematics (Moschkovich, 2007; Setati & Adler, 2000; Webb & Webb, 2008). Furthermore, teachers could adopt academic, mathematical language in verbal discourses and endorse the anticipation that pupils will come to practice such language. The use of a simplified form of the official language by teachers does not guarantee that pupils have better access to the mathematical content. On the contrary, it may constitute an additional barrier because it prohibits learners' acquisition of rich mathematical concepts by obscuring them (Adler, 1997; Gorgorio & Planas, 2001).

Recently, Moschkovich (2012) proposed a more comprehensive set of instructional techniques for teachers dealing with language issues in mathematics classrooms. These include focusing on pupils' mathematical reasoning, not accuracy in adopting a language; shifting to a focus on mathematical discourse practices and moving away from simplified views of language; recognizing and supporting pupils to engage with the complexity of language in mathematics classrooms; treating everyday language and experiences as resources, not as obstacles; and finally, uncovering the mathematics in what pupils say and do.

Studies deriving from the so-called developing world conclude that teachers seem to have concerns about the socio-political status of language in mathematics classrooms. For instance, in many African countries, a colonial language (i.e., English, French, Portuguese) is the official language of instruction, while, at the same time, it is neither the teachers' nor pupils' home language (Chitera, 2011). For example, in a study in Botswana (Kasule & Mapolelo, 2005), primary teachers appeared to hold strong views about having to adhere to the official language policy because it is believed that children learn better mathematics when they are taught in English than in any other language. Guided by such beliefs, teachers of Botswana

employed a number of language games and organizational strategies in an attempt to help their pupils learn mathematics, as taught in English.

Similarly, in the context of post-apartheid South Africa, Setati (2005) reports the case of a primary teacher, who taught in a school where the majority of the pupils spoke Setswana as their first language, even though the official language of instruction was English. The teacher was confronted with two conflicting and competing identities when teaching mathematics: the identity of a mathematics teacher in an English-language dominated world, who believed that pupils should be able to communicate mathematics in English; and the identity of a South African who had experienced language discrimination during apartheid, and who now wanted to promote the use of the pupils' home language to enhance its standing as a legitimate language of interaction in a mathematics classroom, as well as to empower the learners' identities.

In the second cluster, there are studies focusing on how pupils' diverse cultural backgrounds could be leveraged in mathematics classrooms. Such studies typically examine the effects of intervention programs on pupils and teachers (i.e., attainment, conceptions, etc.). For programs of this kind to create environments where pupils are able to demonstrate significant progress, the philosophy of their design and the teachers' instructional philosophy need to be compatible (Civil & Wiles, 2005). Examples of such programs are reported in Esmonde and Caswell (2010) and Gutstein (2003), who locate their work in equity and social justice, and are concerned with how inequitable mathematics classrooms can be transformed into equitable ones.

In turn, Gay (2002) talks about culturally responsive mathematics teaching. Such a notion, she claims, implies, among other things, teachers' general and specific knowledge about the cultural values, traditions, and learning styles of different ethnic groups; knowledge in how to determine the multicultural strengths and weaknesses of curriculum designs and instructional materials and how to make necessary changes to improve their overall quality; and thorough and critical analyses of how ethnic groups and experiences are depicted by mass media and popular culture.

In a similar vein, Averil and Clark (2013) conclude that certain practices employed by mathematics teachers are seen as respectful towards pupils' cultural backgrounds, both by the teachers themselves and the pupils. These include: being well prepared for mathematical challenge and listening; enabling pupils' mathematical decision-making; providing mathematical assistance and feedback; and differentiating teaching while, at the same time, holding high academic standards for all learners. Much research on social justice and culturally responsive mathematics teaching has taken place in Australia, New Zealand, and the United States (see, e.g., Averill et al., 2009; Bartell, 2013; Boaler, 2008; Zevenbergen, Niesche, Grootenboer, & Boaler, 2008). Common issues that arose from these studies regard

the tension experienced by teachers in accommodating pedagogies of this kind, as well as the necessity for more professional development programs so that the opportunities such teaching raises are better embraced by the teachers.

### **Mathematics Teacher Education and Diversity**

“Mathematics education in practice is, and always should be, mediated by human teachers” (Bishop, 1988, p. 189). As Bishop states, teachers must be able to identify the values inherent in the subject they are responsible for; they must be informed about the cultural history of their subject and reflect on their relationship to those values; and they must be aware of how their teaching contributes not only to the mathematical development of their pupils but also to the development of mathematics in their culture. Nonetheless, Bartell (2011) points out the lack of published work on how to support in-service mathematics teachers in developing pedagogies that address diversity issues. Changing the mind-set of experienced (mathematics) teachers in order to accommodate culturally and linguistically responsive pedagogies is a hard process (Gorgorio & Planas, 2001) and not always a successful one.

For instance, in their work with experienced in-service teachers in three European countries (Italy, Spain, and Portugal), Favilli, Oliveras, and César, (2003) discuss how participants highlighted the need for support in their attempt to teach mathematics to minority and immigrant pupils. The teachers, however, appeared to be reluctant in shifting their practices for accommodating changes even after a series of professional development seminars and the provision of specially prepared digital supportive materials (César & Favilli, 2005). Yet, designing and implementing successful professional development programs is possible, as Planas and Civil’s (2009) study with secondary mathematics teachers in Barcelona informs us. Participants, who were working in schools located in impoverished areas with high percentages of immigrant pupils, were involved as co-researchers in a program investigating their local contexts and practices. By the end of the program, the teachers developed awareness of their local situation, and questioned and reformed their own practices to encourage pupils’ active participation in class.

From the perspective of pre-service mathematics teacher education, the lack of research related to cultural and linguistic diversity may imply that these issues are missing from many preparatory programs around the world. For instance, Chitera (2011) underlines the need for inclusion of courses in language and mathematics and in diversity and mathematics in the teacher preparation programs of many African countries. Because most programs were developed before these countries gained independence, pre-service teachers are currently being trained to teach all subjects, including mathematics, in their former colonial languages. In the context of New Zealand, Patadia and Thomas (2002) examined seven teacher education centres and

assessed whether multicultural perspectives on mathematics teaching had been introduced into these programs. In their research evaluations, they have found that there are no formal or specific guidelines available for a particular model or approach to mathematics teacher education programs, as far as diversity is concerned. Similar observations have been made by Xenofontos (2014b) with respect to the reception programs in the Republic of Cyprus.

Various successful efforts to develop pre-service teachers' awareness and competence for mathematics teaching in diverse settings have been reported. Many of these efforts have taken place in the United States. For instance, Aguirre, Zavala, and Katanyoutanant (2012), who see the development of culturally responsive mathematics teachers as the intersection of two sets—culturally responsive teaching and pedagogical content knowledge—discuss their work with pre-service teachers to develop the latter's knowledge in mathematics teaching in diverse settings. Aguirre and colleagues assigned student teachers the task of analysing their own lessons from their school placements by giving them a rubric, as well as the task of writing reflections. Other similar examples in a U.S. context finding a positive impact on participants' beliefs are those of White, Murray, and Brunaud-Vega (2012) and Turner and colleagues (2012). Eliciting and making sense of pupils' cultural, home, and community-based knowledge, and its relevance to mathematics instruction is a process that begins much earlier, during pre-service teachers' preparations, and continues developing as teachers enter the field (Anhalt & Rodríguez-Pérez, 2013; Civil, 2007). If pre-service teachers "carry this awareness into their future careers as mathematics teachers, this is a start on negotiating mathematics classrooms in which cultural diversity is affirmed and valued" (Presmeg, 1998, p. 336).

In general, it appears that in different parts of the world, mathematics teachers have context-specific concerns with respect to teaching the subject to pupils from diverse backgrounds. Regardless of the particularities of each setting, however, these concerns are related to language and culture. It is important for teachers to learn about the links between these two factors and mathematics, as a school subject, during their teacher education studies and as part of their in-service professional development. To improve teachers' pedagogical repertoire in the Republic of Cyprus, I conducted this study, aiming to map the local landscape and set the ground for professional development programs to be organized.

## **Methods**

### *Participants*

This project employs a collective case study methodology (Goddard & Foster, 2002; Yin, 2009). As Goddard (2010) explains, "Collective case study involves more than one case, which may or may not be physically collocated with other cases" (p.

164). In such an approach, “cases are chosen because it is believed that understanding them will lead to better understanding, perhaps better theorizing about a still larger collection of cases” (Stake, 2005, p. 446). The participants here were 16 Greek-Cypriot teachers from three neighbouring urban elementary schools belonging to the same Zone for Educational Priority (ZEP), while the pupil population of each school includes more than 90% of immigrant pupils.

All 16 teachers comprise the collective case of this article. The graduates of the three schools attend the same lower-secondary school, which is also in the same area. Initially, the three head-teachers were contacted and asked whether they would like their schools to participate in this study. All responded positively and informed their colleagues about the project. Sixteen volunteers expressed an interest to get involved. Table 1 presents some demographic information about the teachers, their gender, and years of teaching experience in general, and specifically, with immigrant pupils. Due to the fact that teachers in Cypriot state schools are obliged to be fluent in Greek to be employed, the majority of the teacher population comprises native Greek-Cypriots (who speak the variety of Standard Modern Greek, the Cypriot dialect, and in most cases, English), with a small percentage coming from Greece. Typically, teachers belong to the dominant Greek-Orthodox ethnic culture, while, in sociolinguist terms (see Yiakoumetti & Esch, 2010), most Greek-Cypriot teachers could be labelled as bilingual-bidialectal, speaking English and two varieties of Greek. For ethical reasons, and to maintain participants’ anonymity, each is given a pseudonym. The teachers are presented according to the alphabetical order of their pseudonym.

*Table 1*  
**The Participants**

<b>Pseudonym</b>	<b>Gender</b>	<b>Years of Teaching Experience</b>	<b>Years of Experience w/ Immigrant Pupils</b>
Andreas	Male	15	6
Athena	Female	20	12
Elenora	Female	9	4
Elina	Female	7	4
Ioanna	Female	9	4
Leonidas	Male	7	1
Martha	Female	6	2
Mary	Female	24	16
Nikos	Male	23	13
Panayiota	Female	25	19
Petros	Male	20	4
Phaedra	Female	7	3
Sonia	Female	15	14
Sophia	Female	7	1
Stephanie	Female	15	14
Theodoros	Male	8	3



*Data collection and Analysis*

Each participant was invited to an individual semi-structured interview. Elements of narrative research were involved in the interview questions for the purpose of establishing honesty and trust between the researcher and participants (Connelly & Clandinin, 1990; Lichtman, 2013). More specifically, the participants were encouraged to share stories of their lives as mathematics teachers of immigrant pupils. In a previous article, I discuss findings from the same project addressing how teachers view their immigrant pupils as learners of mathematics (Xenofontos, 2015). Here, as noted previously, I address two questions (a) What are teachers' reported practices in facilitating immigrant pupils' learning of mathematics? (b) What professional needs do teachers have in assisting their immigrant pupils' learning of mathematics? Each interview lasted 30–40 minutes, and was audio-recorded and transcribed soon after. Table 2 includes examples of questions related to each of the two research questions.

*Table 2*  
**Examples of Questions Included in the Interview Protocol and Their Relationship to a Specific Research Question**

Research Question	Examples of Questions Included
What are teachers' reported practices in facilitating their immigrant pupils' learning of mathematics?	<ol style="list-style-type: none"> <li>1. What specific practices, if any, have you adopted that you consider effective for immigrant pupils' learning?</li> <li>2. How do you manage pupils' difficulties, when they arise? What do you do to help them overcome them?</li> <li>3. To what extent do you differentiate your teaching to compensate their needs?</li> <li>4. How can teachers support immigrant pupils so they can develop a better understanding of mathematics?</li> </ol>
What professional needs do teachers have in assisting their immigrant pupils' in learning mathematics?	<ol style="list-style-type: none"> <li>1. To what extent do you consider yourself prepared to manage a mathematics class with immigrant pupils?</li> <li>2. What kind of support do teachers have for their efforts?</li> <li>3. What kind of reinforcement do you wish you had in order to assist immigrant pupils in mathematics?</li> </ol>

No predetermined, specific coding scheme was utilized for data analysis. By employing both the ideas of coding and categorization (Kvale & Brinkmann, 2009; Miles & Huberman, 1994) and the constant comparison process (Strauss & Corbin, 1998), several categories were identified and clustered under general themes, which corresponded to each of the initial research questions.

## Participants' Reported Instructional Practices

Data analyses identified four reported instructional practices employed by the teachers to facilitate immigrant pupils' learning of mathematics. Briefly, these are: language support during reception classes, minimizing verbal language use and visualizing mathematical concepts, lowering expectations, and getting help from "translators." Each reported practice is discussed below.

### *Language Support During Reception Classes*

Ten of the teachers argued that during reception classes the main goal for their immigrant pupils was to learn Greek. Acquiring basic communicative skills, they claimed, were most important, for the specific pupils. During these classes, no support in mathematics was given because learning the subject was expected to come naturally once pupils grasped the Greek language. Similar practices are reported by Gorgorio and Planas (2001) in Catalonia, during reception classes, whereby "from the point of view of the educational administration, not knowing the language is the *only* problem immigrant students face" (p. 8, emphasis in original). Here, Mary, an experienced teacher and head of her school, commented: "We need to focus on language and pupils' communicative skills. Learning mathematics will come naturally later because mathematical skills are based on linguistic skills." In a similar vein, Panayiota, also head of her school, explained that during reception classes, "emphasis is given to language. For these classes, pupils are grouped according to their language competence, beginners, intermediate, and advanced, so we basically work on language." Only one teacher, Sophia, questioned this practice, saying:

Maybe our school system has not realized that mathematics learning is based on language and that in mathematics classes, there are too many instructions expressed in verbal form. In many teachers' and school inspectors' minds, mathematics is just about symbols and numbers, so they think that there is no need for language support.

Andreas was the only teacher who claimed to split his reception class time equally between language and mathematics:

During these classes, I explain what has been learnt in the regular class during that day or week, by emphasizing the understanding of keywords so that the kids can understand what the lesson was about. For example, if we're learning about multiplication, they need to understand the concepts of "factors" and "product." ... We have a regular blank notebook that we named "mathematical dictionary," in which we write the name of each concept and then use symbols so that the kids will match the word with a mathematical symbol. For example, we'd write the word "addition" and then the symbol "+" next to it.

*Minimizing Verbal Language and Visualizing Mathematical Concepts*

For the vast majority of the participants, the use of language and verbal explanations, instructions, and examples in mathematics lessons need to be minimized. In particular, 14 of the teachers claimed that they tried to reduce language activity in their mathematics teaching for immigrant pupils. For example, Elina said, “It’s better to avoid having many language elements in mathematics lessons.” Her response demonstrates what has also been expressed by other participants; for example, Stephanie complained, “verbal tasks are difficult for them [the pupils], so I focus on simple things, like place value and sums.” She added:

Honestly, I believe that they need to learn the language first and then enter the classroom. ... Yes, mathematics is an international language, numbers and stuff, but it includes verbal problems and instructions as well. How can you explain these when you can’t communicate with the pupil?

In a similar spirit, Panayiota commented on how in her teaching she often uses “tasks, which are more general”:

Take tasks with numbers and sums, with little circles and arrows that show which arithmetic operation needs to be done, for example. With these, you can differentiate your goals without changing their structure, but by changing the numbers. If, for example, you have a pupil who has many difficulties, and not only with language, you can give her/him exercises of addition, subtraction, multiplication, and division with numbers below 20. The same task can be given to a stronger pupil, but with bigger numbers. ... Tasks of this kind do not involve language. [Immigrant pupils] can solve them without feeling they are different.

All teachers here argued that to minimize language interaction in mathematics lessons, pupils need to visualize mathematical concepts by means of pictures and mathematical manipulatives, both physical and virtual. According to Leonidas:

visualization and the use of materials are very important since the pupils do not understand language. When they don’t understand a written text, then you have to present it in many different ways. Materials do not involve language. With these, they can understand mathematics more easily.

Technology assists teachers in this attempt, the teachers claimed. “There is mathematical software, and these media help other-language pupils,” stated Nikos. Athena, in turn, offered examples of using online games in her teaching. She reported:

I use various games on the Internet all the time, and I’ve come to realize that they are very helpful. There are games like football, basketball, rugby, monopoly, stuff that

kids like and find helpful. For example, when I was teaching how to round numbers up, I used many online games, which had a timer and were really challenging for the pupils. Later, when they had a test, they all did well! They were rounding up to the nearest unit, tenth, hundredth, thousandth, or tens, hundreds, thousands, without any difficulties.

Indeed, visualizing mathematical concepts has been found to be effective for other-language pupils' learning mathematics by a number of related studies (Anastasiadou, 2008; César & Teles, 2005). However, the teachers here do not seem to recognize the important role language plays in mathematics lessons (Anhalt & Rodríguez-Pérez, 2013; Durkin, 1991). Approaches like simplifying or even minimizing language use in mathematics classrooms have also been reported in other countries (e.g., Gorgorio & Planas, 2001); however, these may constitute an additional obstacle for other-language pupils by actually preventing the development of a deep conceptual understanding of mathematics (Adler, 1997; Moschkovich, 2012).

#### *Lowering Expectations in Regular Class*

With respect to the regular class, lowering their expectations to what immigrant pupils can achieve in mathematics is an issue discussed by 10 of the participants. These teachers argue that classroom realities, a heavy curriculum, and tight timeframes do not leave space for differentiation in instruction, methods or materials; on the contrary, lowering their "expectations regarding their pupils' learning capacities, skills, and outcomes is all teachers can do," claimed Martha. Likewise, Phaedra argued that differentiation of instruction

is impossible! If you had only 2 or 3 kids on different levels, then you could work something out. But if you see my class, oh, there are so many kids on different levels. I wish I could clone myself endless times to satisfy everyone's needs. But I can't please everyone at once.

From a similar perspective, Panayiota added:

Let's be honest with ourselves. Our school programme and curriculum do not leave time for this. When you have a class of 25 pupils, you can't just differentiate your teaching for immigrant pupils. Besides, everyone has different needs. There will always be someone whose needs are not met.

Theodoros's opinion below corresponds to those of his colleagues:

Differentiating instruction in such settings is a myth. This whole idea is really nice and works in theory, but in reality it's not always easy. School inspectors share this rhetoric as well. Ok, I'm not saying it's always impossible; there are some cases where

this can happen, but you can't do it throughout the school year because differentiation is not just for mathematics. ... All you can do is lower your expectations and simplify things for immigrant pupils.

Two of the teachers claimed that differentiation was necessary and they applied it consistently in their instruction. However, when they were asked to give examples of such practices, they referred to giving immigrant pupils “worksheets with simpler tasks” (Ioanna) or having them practice with “computer software and applets for younger kids” (Petros). In general, the participants in this study seem to have very specific views on what is possible to be differentiated in a mathematics classroom. By lowering their expectations for immigrant pupils, they somehow shift the responsibility away from themselves. Such a perception is far from the views of scholars, like Adler (2001), Leonard (2008), Zaslavsky (1996), and Tucker, Singleton, and Weaver (2006), who propose various strategies for adapting mathematics lessons so that they meet diverse learning needs. Others, like Civil and Wiles (2005), Esmonde and Caswell (2010), and Gutstein (2003), who position their work within a perspective that fosters social justice for all, argue that mathematics teaching needs to be reconceptualized and tailored to the needs and interests of immigrant pupils so that they can be part of a more inclusive educational system. In countries like the United States, where research on the issues of race has taken place for sometime, the lowering of teachers' expectations to compensate for the differences in minority pupils is perceived as a form of racism (Davis, 2003; Solórzano, 1998). However, it might not be the case that the Cypriot teachers in this study lower their expectations because of racist dispositions but due to a lack of knowledge and informed insight on related pedagogical approaches, the poor support ZEP schools receive, as well as the overall bad organization of the MoEC. These issues are discussed subsequently.

### *Getting Help from Translators*

Including pupils as assistants in mathematics lessons, who are competent both in Greek and another language, was a practice reported by four of the teachers. Sophia, for instance, commented: “When I know the language competence level of my pupils, I make sure I get help from other pupils. For example, if there were two Bulgarian kids, and one of them spoke Greek while the other didn't, I would ask the former to explain the instructions in the common language.” Sophia, Elina, and Martha talked about getting help from other pupils who could translate mathematical instructions in another language. Panayiota, however, who agreed with them, talked about an extension of this practice outside school and the involvement of people from the community, like parents. She said:

A few years ago when I was at a school where I had to teach many immigrant pupils who had just arrived to Cyprus, we established the practice of incorporating people who served as “translators.” They were parents-volunteers who would translate worksheets for us, and/or would come to class to sit with kids and translate mathematical verbal problems and instructions. This way, you expand the school’s role in the community, and you bring the community in, since parents get involved and help children other than their own.

Gorgorio and Planas (2001) reported similar practices in Barcelona. In that context, as they explain, adult translators were incorporated only when immigrant pupils would first arrive to the country and would have to take entry examinations so that the school would allocate them to a particular group. In such cases, adults from the community outside school would sit with them during the examination and help the pupils with language issues.

### **Participants’ Professional Needs**

The participants indicated a number of professional needs in their effort to support immigrant pupils in mathematics. Briefly, the teachers talked about difficulties because of the Ministry of Education and Culture’s (MoEC) “bad” organization; the need for appropriate pre- and in-service teacher education; the need for a specialized curriculum; and the need for a teaching assistant. Presented below is a discussion of each need.

#### *Difficulties Because of the MoEC Bad Organization*

All 16 teachers emphasized how the bad organization of the MoEC, as far as ZEP schools are concerned, has created many difficulties to them as professionals. Theodoros, for instance, pointed out: “The Ministry needs to decide what it wants. We have no specific guidelines on how we should work with our immigrant pupils, and this, to me, is unprofessional. We don’t know what we should expect them to learn.” Sadly, the participants’ views here are in line with the conclusions of other national studies (e.g., Hajisoteriou, 2009, 2010) that indicate how, despite the Republic’s official intention of adherence to the educational goals of the EU, a coherent state-derived multicultural policy does not exist.

In addition to the lack of clear guidelines, Sophia summarized the views of her colleagues by talking about other prohibiting factors that derive from the MoEC’s bad organization. She said: “Due to the financial turbulence Cyprus is experiencing in recent years, the Ministry has decreased the teaching periods of reception classes for other-language pupils. This way, instead of dealing with the problems, we create more.” Sophia went on by stating that MoEC’s policies did not fully take research evidence into consideration:

Take you, for example. You're a researcher working in this area in order to help these pupils learn mathematics, and I really appreciate your efforts. I don't want to sound too pessimistic but I don't really think they [the MoEC] will listen to what you have to say. They don't utilize the results of academic research. The Ministry promotes people and ideas based on other criteria, like politics, and not according to one's qualifications and the importance of what they have to say.

### *The Need for Appropriate Pre- and In-Service Teacher Education*

Addressing the issue of teachers' needs for appropriate pre- and in-service education regarding diversity, and the teaching and learning of mathematics, emerged from all participants' responses. Angelides and colleagues (2003) made similar observations, more than a decade ago, and argued that teacher education from the perspective of cultural diversity in the Cyprus Republic was practically non-existent. As Mary, one of the teachers here, argued, "we are basically 'experimenting' because we are not properly prepared for teaching mathematics in diverse classrooms," an opinion shared by many of her colleagues. Martha responded: "It's up to each teacher to discover strategies that work in a classroom. From my experience, no one has ever told me how to approach mathematics teaching for pupils with diverse backgrounds."

Nine of the teachers in this study were below the age of thirty and with less than nine years of work experience. They all drew upon their pre-service teacher education experiences, arguing that their undergraduate programs did not include modules on diverse mathematics education. Studies examining the content of teacher preparation programs in other countries have reached similar conclusions (see, e.g., Chitera, 2011; Patadia & Thomas, 2002). During her first years as a teacher, Ioanna argued that she felt

hopeless! Assigning young teachers with no experience to ZEP schools is tragic. We were not properly prepared during our undergraduate studies. I felt that I wasn't qualified to teach Greek or mathematics to non-native speakers. We were not prepared at all. Our studies did not include modules on teaching language, mathematics or any other subject to non-indigenous learners.

In a similar vein, Leonidas stated that teacher preparation programs should include diverse mathematics education classes because the demographics of Cypriot society have changed. More specifically, he said:

I guess the reason we didn't have such classes during our undergraduate studies was because back then our schools and classrooms were not so diverse. But in recent years this has changed. It is necessary that prospective teachers are appropriately prepared.

Additionally, all 16 participants stressed the lack of diverse mathematics education seminars for in-service teachers. As Theodoros said: "I don't think I've

ever heard of seminars in diverse mathematics education. There are a few about language and education in general, but nothing related to mathematics.” For participants, such seminars were important because as Stephanie said, “[Seminars] would be practical because most of the times we are lectured about teaching practices which are far from classroom realities.” Nikos claimed that seminars of this kind would need to take place during school time, and not in the afternoons:

On the one hand, we all need to be properly trained. On the other, teachers need motivation. What do I mean by this? Maybe they should give us less teaching hours and instead encourage us to participate in training programs in diverse mathematics education. Maybe it’s wrong, I don’t know, but teachers need motives. If such seminars take place in the afternoons, then not many teachers would express interest. This is why the seminars need to be in the morning. Unfortunately, most teachers want rewards. If this could be done by exempting them from a few teaching hours, then let it be.

### *The Need for a Specialized Curriculum*

Twelve participants commented on the inappropriateness of the mandatory national curriculum and textbooks in relation to immigrant pupils’ mathematical learning. In particular, teachers who raised this issue argued that the current mathematical materials, prepared by the MoEC, mainly refer to typical indigenous pupils and do not take into consideration the needs of culturally diverse learners. In a characteristic response, Sonia said:

Let’s take the mathematics textbooks of grade 4 that I’m teaching this year. I’m not saying that the problems included are hard for a typical 10-year-old. But they definitely don’t refer to other-language pupils. They refer to children who speak Greek as a native language.

The fact that there are no official materials (i.e., books) for other-language learners of mathematics was time consuming for teachers, who have to dedicate extra time and effort to prepare something else, said Elina. As she claimed: “It would be helpful if we were given some teaching materials specifically designed for diverse pupils. This would save us a lot of time. Something like an online platform with worksheets and teaching ideas.” Other teachers argued, because mathematics textbooks rely a lot on language, it would be helpful if they were translated into other languages as well. For instance, according to Mary:

It’s well known that in Cyprus most immigrant pupils are Arabic speakers, Russian speakers, and Bulgarian speakers. These are the main languages of immigrants in our schools. I think it would be helpful if our mathematics textbooks were translated to these three languages.



Martha was the only teacher who talked about mathematics learning outside the classroom and did not rely on textbooks. In her view, ZEP schools should have participated in other activities in the real world:

There should have been other programs for ZEP schools. We shouldn't follow the same curriculum and textbooks. For example, our pupils could visit a real work environment, like a market, and participate in activities there, related to mathematics. Or we could organize a Mathematics Week, during which our pupils could learn mathematics through hands-on activities, like cooking or through drama. This would be different, more interesting, and, I believe, effective for diverse learners.

The fact that only one teacher commented on mathematics learning through activities that do not involve the use of the national textbooks is not surprising. In the Cyprus Republic, the vast majority of mathematics teachers rely on the textbooks provided by the MoEC and do not easily deviate from them (Mullis, Martin, & Foy, 2008; Xenofontos, 2014a). Nevertheless, similar concerns about the need of specialized teaching materials for immigrant pupils were expressed in the past by teachers in Italy, Spain, and Portugal (Favilli et al., 2003). Furthermore, those teachers hesitated to modify their instructional practices so to incorporate digitally supportive materials developed by a team of researchers (César & Favilli, 2005). Culturally responsive mathematics teachers, argues Gay (2002), need to determine the multicultural strengths and weaknesses of curriculum designs and instructional materials and learn how to make necessary changes to improve the overall quality of such materials. The teachers in this study recognized weaknesses in the current curriculum, but did not seem to be able to adapt parts of it to fit their needs, as well as their pupils' needs, in a more direct way. Quite the contrary, they waited for top-down changes initiated by the MoEC.

#### *The Need for a Teaching Assistant*

Four of the teachers talked about the need of a teaching assistant in mathematics classrooms with diverse pupils. Such a practice is quite common for the general classrooms of state schools in countries like the United Kingdom. In the Cyprus Republic, however, teaching assistants are provided only in cases where there are pupils with special learning needs, (Angelides, Constantinou, & Leigh, 2009), that is, pupils who have mental and/or kinaesthetic disorders. Culturally and linguistically diverse pupils are "really wronged. They are not allowed to have support as learners with special needs," said Sophia. "Having a teaching assistant in mathematics classrooms would be ideal," said Nikos. "That person could help immigrant pupils with both the mathematical content and the issue of language in the tasks. Ok, teachers do help them, but when you have 25 kids in a class, your time is limited." If immigrant pupils had support from an assistant, "if they had someone especially for them, they would learn more naturally," claimed Ioanna.

### Concluding Remarks

Overall, the findings from this study suggest participants' instructional practices for supporting the mathematical learning of their pupils focus mainly on the issue of applying language as a means of basic oral communication. This finding is not surprising, considering, as argued elsewhere (Xenofontos, 2015), the same teachers hold a strong belief that claims linguistic barriers are the main source for the many difficulties that immigrant pupils encounter in mathematics classrooms. As a result, the teachers here do not seem to employ any strategies that take pupils' cultural background into consideration (e.g., Civil & Wiles, 2005) or to cultivate attitudes towards social justice through mathematics (e.g., Esmonde & Caswell, 2010; Gutstein, 2003). Quite the contrary, some of their reported practices, for example, minimizing verbal language use and lowering expectations, are not considered to have a positive impact on diverse pupils' learning of mathematics by most scholars (e.g., Adler, 1997; Moschkovich, 2012).

The implementation of priority policies to support disadvantaged pupils, like immigrant children, is typical of many European countries (Muskens, 2011). However, although the "classic" positive discrimination programs, as, for example, the Republic's ZEP policy, differ across countries in administrative approach and intensity, "they have proved to be remarkably similar in one respect, that is, the limited results they have achieved" (Karsten, 2006, p. 277). In the case of the Republic of Cyprus, research evidence (e.g., Hajisoteriou, 2009, 2010) indicates that there are no clear local guidelines regarding the implementation of EU diversity policies in education, a fact reflected in the mathematics teachers' comments reported here. This is, in fact, in opposition to the philosophy of the new curriculum, launched in 2010, which makes explicit references to the culturally diverse character of contemporary Cypriot society, and aims at creating democratic and humane schools (MoEC, 2010). In spite of the presence of this reference in the official documents, no specific guidelines are provided for ZEP schools, and teachers working in diverse environments are required to follow the same curriculum and national textbooks as do schools with a mainly native population (Xenofontos, 2015). As far as teacher education is concerned, the participants' views, here, echo my previous observations that none of the undergraduate preparation programs in the Republic of Cyprus include modules on diverse mathematics education (Xenofontos, 2014b). In addition, this fact does not correspond, unfortunately, to the research of scholars, like Presmeg (1998), which propels the condition that mathematics teachers' cultural awareness be developed as early as possible, preferably, during their teacher preparation studies.

Every study carries a set of limitations. In the work presented here, the findings are based solely on interview data, and, unfortunately, no other method was utilized for triangulation. For this reason, I have chosen to talk about teachers'

reported practices, given that, at this stage, they could not be compared to observational data on what actually happens in classrooms. Nevertheless, due to the lack of other related studies in the context of the Republic of Cyprus, this small-scale research project has an exploratory character, in the sense that its main purpose is to lay the groundwork for further studies in the field. Once again, I would like to take the opportunity to openly invite the mathematics education research community of the Republic of Cyprus to join me in an attempt to better equip teachers who work in diverse settings. Future collaborations could take various forms, as, for example, systematic analyses of teachers' instructional practices in order to develop an appropriate in-service teacher education programme, and instructional materials that may enhance teachers' attempts to further assist immigrant pupils as learners of mathematics. These efforts could be part of our contribution, as mathematics educators, to the MoEC's goal to create democratic and humane schools, within which diversity will be respected, celebrated, and advanced forward.

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